CSCI 340 — Homework 2

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1. If the only difference between \( L \) and \( L^* \) is the word \( \lambda \), is the only difference between \( L^2 \) and \( L^* \) the word \( \lambda \)? (\( L^2 \) is the language \( LL - L \) concatenated with itself).

2. For each of the problems below, give a regular expression which only accepts the following. Assume \( \Sigma = \{a, b\} \)
   
   (a) All strings that begin and end with the same letter
   (b) All strings in which the total number of \( a \)'s is divisible by 3
   (c) All strings that end in a double letter

3. Show the following pairs of regular expressions define the same language
   
   (a) \((a + bb)^a(a) + (a + bb)^a a\)
   (b) \((ab)^a a \) and \(a(ba)^*\)
   (c) \((a^*bb)^a a^* \) and \(a^*(bbba)^*\)

4. Describe (in English phrases) the languages associated with the following regular expressions
   
   (a) \((a + b)^a(\lambda + bbbb)\)
   (b) \((a(aa)^b(bb)^*a^*\)
   (c) \((a + b)a^*\)